

A CONTAINER FOR ECLOSION AND HOLDING ADULT INSECTS PRIOR TO MASS RELEASE

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The mass release of adult insects requires containers for eclosing pupae and, at times, for holding adults for several days (e.g., Tanaka boxes used in the release of sterile fruit flies *illus.* in Holler, et al. 1984). These units can be both bulky and expensive. Casual observation of large numbers of confined insects has shown that the majority of their time is spent resting on cage walls or on objects in the cage. The large air volume of a cage is essentially wasted space. With this in mind, a container in the shape of a bag roughly the size of a pillow case was designed for eclosing and holding large numbers of adult braconid parasites. The eclosion bag is mostly "walls," takes up little room, and is easy to move about, both within the rearing/eclosion facility and during transportation to release sites.

The bags are made from pieces of 32 x 32 nylon mesh screen (Lumite, Inc., Gainesville, GA.) that are sewn together and closed continuously across the bottom and the length of one side by velcro strips. For our purposes, we found that a bag 60 cm wide and 90 cm long was ideal, but smaller as well as larger bags (up to 2m long) have been constructed, and insects have been successfully maintained in them. Earlier designs had rounded edges on the bottom to prevent insects from accumulating in corners and "milling." The parasite being held in our research, *Diachasmimorpha longicaudata* (Ashmead), did not display this behavior to any significant extent, and bags with square-edges proved easier to sew and cheaper to produce. Should these bags be adapted for use with insects in which milling is typically a problem, e.g., tephritid fruit flies, the inclusion of rounded bottom corners might be considered.

During the holding/maturation period, parasites were fed a solution of honey and water that was poured into 30 cm polyethylene tubes with an inner diam of 10 mm. The tube ends were closed with 3 cm cotton wicks. The diluted honey seeped through the wick and provided a feeding surface for the insects. To prevent either dripping or incomplete absorbance, we found it necessary to vary the proportions of honey and water with changes in temperature and relative humidity. The tube was held along the upper margin of the bag with a large (#5) binder clip. Cages were then hung from lines, sometimes at two levels in rooms of normal height (~ 2.5 m). An S-hook or open paper clip fitted through the binder clip and then over the line made an effective hanger.

Parasitized Caribbean fruit fly pupae (*Anastrepha suspensa* (Loew)) were poured evenly on the bottom of the bag. A typical volume was 375 ml, which gave rise to approximately 5000 adult parasites.

For our needs, adults were maintained in the bags for five days after the first eclosion. They were then taken by vehicle to the release sites. Lines strung in the back of a van provided a convenient method of suspending them during transportation, although bags could be laid flat and stacked several deep with no apparent ill effects on the parasites.

At the release site, the feeding tube was removed, the velcro opened, and the pupal remains poured into a bucket. The bag was spread open and shaken in the air. This was a particularly useful technique in releasing *D. longicaudata*, which have a rela-



Fig. 1. A bag cage being fitted with a feeding tube.

tively powerful grip and are often difficult to remove en masse from conventional cages.

Adult survival in bag containers appeared similar to that in typical screen cages during a one-year-long augmented parasite release program in which 1 to 1.5 million parasites per week were released. This was verified in a laboratory study that compared mortality in bag cages and 30 x 30 x 30 cm screen cages. Fifteen ml of irradiated and parasitized pupae were put in five of each type of cage (Sivinski & Smittle 1990). The day on which the first adult in any particular cage eclosed was considered day one. The numbers of live and dead insects were counted after five days. There was no significant difference in either emergence or mortality between the two types of containers (t-test, SAS Institute, 1987); \bar{x} live insects bag = 60.6 (SE=8.4) vs \bar{x} live insects cages = 59.4 (5.8) df=8, t = 0.12, p = 0.91; \bar{x} dead insects bag = 3.2 (0.92) vs \bar{x} dead insects cage = 1.41 (0.37), df = 8, t = 1.41, p = 0.20.

The bags wear well during extended periods of use, although care needs to be taken to keep the velcro clean because dirt adhering to the velcro can prevent it from closing uniformly. Small open spots can be "mended" with a paper clip.

The portability of the bags has proven to be a particular asset. They are presently being used in the mountains of Guatemala where thousands of insects are transported into steep and thickly-vegetated areas that would otherwise be difficult to reach on foot.

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SUMMARY

A bag cage is described for holding and maintaining insects for use in mass release programs. Field experience and data have shown that insect survival in this cage is comparable to that in standard screen cages. In addition, the cage is easily portable, especially in hilly, heavily vegetated areas.

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